

REMARKS/ARGUMENTS

Claims 13, 14, 16 and 19-29 are pending. By this Amendment, claims 30 and 31 are cancelled and claims 13 and 19 are amended. Support for the amendments to claims 13 and 19 can be found, for example, in original claims 13, 19, 30 and 31. No new matter is added. In view of the foregoing amendments and following remarks, reconsideration and allowance are respectfully requested.

Rejection Under 35 U.S.C. §112, First Paragraph

The Office Action rejects claims 30 and 31 under the written description requirement of 35 U.S.C. §112, first paragraph.

By this Amendment, claims 30 and 31 are cancelled, rendering the rejection moot. However, the subject matter of claims 30 and 31 has been incorporated into claims 13 and 19, so Applicants provide the following comments. The objected to subject matter provides that "the cerium oxide is calcined at a temperature of from 120 to 400 °C." The present specification describes a "calcination temperature is preferably 400°C or lower." See present specification, page 15, lines 3 to 4. The present specification further discloses particular calcination temperatures: "[t]he Ag-containing cerium oxide was dried (calcined) at 120°C" (see present specification, page 27, lines 10 to 11) and "within a calcination temperature range of 120 to 500°C" (see present specification, page 28, lines 11 to 12). Thus, the present specification plainly describes the endpoints of the calcination temperature ranges recited in claims 13 and 19. *See* MPEP §2163.05.III (citing *In re Wertheim*, 191 USPQ 90 (CCPA 1976)).

For the foregoing reasons, claims 30 and 31 are fully supported by the specification as filed. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

Rejection Under 35 U.S.C. §112, Second Paragraph

The Office Action rejects claims 19, 30 and 31 as indefinite under 35 U.S.C. §112, second paragraph. By this Amendment, claims 30 and 31 are cancelled and claim 19 is amended, obviating the rejection.

Rejections Under 35 U.S.C. §103

A. Gislason and Ino

The Office Action rejects claims 13, 14, 16 and 20-30 under 35 U.S.C. §103(a) over U.S. Patent No. 6,914,033 to Gislason et al. ("Gislason") in view of U.S. Patent No. 5,268,346 to Ino et al. ("Ino"). By this Amendment, claim 30 is cancelled, rendering the rejection moot as to that claim. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 13 recites "[a] process for producing hydrogen, comprising: desulfurizing a hydrocarbon fuel by contacting the hydrocarbon fuel to an adsorbent comprising cerium oxide, primary particles of the cerium oxide having a mean crystallite size of 10 nm or less; and subsequently bringing the desulfurized fuel into contact with a catalyst comprising at least one member selected from the group consisting of a partial-oxidation reforming catalyst, an autothermal reforming catalyst, and a steam reforming catalyst; wherein: neither hydrogen nor oxygen is added while desulfurizing the hydrocarbon fuel; and the cerium oxide is a cerium oxide that has been calcined at a temperature of from 120 to 400 °C" (emphasis added). Gislason and Ino do not disclose or suggest such a process.

By employing the method of claim 13, excellent desulfurization properties can be obtained without using hydrogen and oxygen and by using a catalyst that was calcined at lower temperatures than are disclosed in Gislason. As indicated above, claim 13 requires use of a cerium oxide that has been calcined at a temperature of from 120 to 400 °C. The Examples of the present specification demonstrate that employing cerium oxides calcined at lower temperatures yield excellent desulfurization properties. In particular, Examples 11-15 of the present specification demonstrate that desulfurization properties (DMS removal) improve as the calcination temperatures of the employed cerium oxides are reduced (500°C → 120°C). *See* present specification, page 28, Table 4.

Gislason generally discloses calcination temperatures of 400-1500 °F (204-816 °C) with a preferred range of 800-1500 °F (427-816 °C). *See* Gislason, column 10, lines 35 to 37. While the broader calcination temperature range in Gislason (204-816 °C) appears to overlap the temperature range recited in claim 13 (120 to 400 °C), the temperature range actually employed in Gislason does not overlap with the range recited in claim 13. As indicated above, Gislason indicates a preferred temperature range for calcination (427-816 °C) that is outside of the scope recited in claim 13. In Example 1 of Gislason, calcination is carried out at a temperature of 635°C, which is outside of the temperature range recited in claim 13. *See* Gislason, column 16, lines 18 to 22. Examination of the remaining Examples in Gislason reveals that in every instance, calcination is carried out at a temperature exceeding the temperature range recited in claim 13.

While the disclosure of Gislason is not limited to the preferred embodiments, Applicants have demonstrated that the calcination temperature range recited in claim 13 provides superior desulfurization performance to the calcination temperatures actually employed in Gislason (*see* discussion above). Moreover, there is no disclosure or suggestion in Gislason that selecting particular temperatures within the broad disclosed range will affect

the performance of the resulting product. As is well-settled, a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *See* MPEP §2144.05 (citing *In re Antonie*, 195 USPQ 6 (CCPA 1977)). Accordingly, Gislason cannot be said to render obvious the particular calcination temperature range recited in claim 13.

Ino does not remedy the deficiencies of Gislason. First, Ino only discloses calcination temperatures that are outside of the range recited in claim 13. *See* Ino, column 3, lines 55 to 57. Second, as discussed previously, Ino discloses a catalyst including cerium and ruthenium for use in steam reforming of hydrocarbons. There is no disclosure or suggestion in Ino of using the disclosed catalyst in a desulfurization process, as in Gislason, which precedes a reforming process. While the Office Action correctly points out that Ino discloses that desulfurization may be carried out before the disclosed process (*see* Office Action, page 3; Ino, column 4, lines 34 to 44), there is nothing in Ino indicating that catalysts of the disclosed reforming process could or should be used in such a desulfurization process. Steam reforming of hydrocarbons is a different process from desulfurization of hydrocarbons in terms of reaction mechanism and reaction category. As is well-settled, a *prima facie* case of obviousness based on a proposed modification to a reference (e.g., replacing the catalyst of Gislason with the catalyst of Ino) will only stand if one of ordinary skill would have had a reasonable expectation of success upon making the modification. *See, e.g.*, MPEP §2143.02 (citing *In re Merck & Co., Inc.*, 800 F.2d 1091 (Fed. Cir. 1986)). One of ordinary skill in the art would have had no reason to expect that the steam reforming catalyst of Ino could function desirably in a desulfurization process as disclosed in Gislason.

Claim 13 would not have been rendered obvious by Gislason and Ino. Claims 14, 16 and 20-29 depend from claim 13 and, thus, also would not have been rendered obvious by

Gislason and Ino. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

B. Ino and Gislason

The Office Action rejects claims 13, 14, 16 and 20-30 under 35 U.S.C. §103(a) over Ino in view of Gislason. By this Amendment, claim 30 is cancelled, rendering the rejection moot as to that claim. As to the remaining claims, Applicants respectfully traverse the rejection.

Claim 13 is set forth above. For the reasons discussed above, Ino and Gislason fail to disclose or suggest each and every feature of claim 13.

Claim 13 would not have been rendered obvious by Ino and Gislason. Claims 14, 16 and 20-29 depend from claim 13 and, thus, also would not have been rendered obvious by Ino and Gislason. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

C. Gislason, Ino and Shore

The Office Action rejects claim 19 and 31 under 35 U.S.C. §103(a) over Gislason in view of Ino and U.S. Patent No. 6,541,419 to Shore et al. ("Shore"). By this Amendment, claim 31 is cancelled, rendering the rejection moot as to that claim. As to the remaining claim, Applicants respectfully traverse the rejection.

Claim 19 recites "[a] fuel cell system, comprising: a desulfurizer; and a reforming apparatus; wherein: the desulfurizer comprises an adsorbent comprising cerium oxide having primary particles with a mean crystallite size of 10 nm or less, the desulfurizer being configured so that a hydrocarbon fuel can be contacted to the adsorbent; and the reforming apparatus comprises a catalyst comprising at least one member selected from the group

consisting of a partial-oxidation reforming catalyst, an autothermal reforming catalyst, and a steam reforming catalyst, the reforming apparatus being configured so that a desulfurized fuel can be contacted to the catalyst; wherein: the system is configured so that neither hydrogen nor oxygen is added when desulfurization is performed; the cerium oxide is a cerium oxide that has been calcined at a temperature of from 120 to 400 °C" (emphasis added). Gislason, Ino and Shore fail to disclose or suggest such a system.

As discussed above, neither Gislason nor Ino discloses or suggests a process in which a cerium oxide that has been calcined at a temperature of from 120 to 400 °C is employed. The Office Action relies on Shore for its disclosure of a fuel cell system. *See* December 26, 2007 Office Action, pages 2 to 3. However, Shore, like Gislason and Ino, fails to disclose or suggest a process or system in which a cerium oxide that has been calcined at a temperature of from 120 to 400 °C is employed. Accordingly, even if the references were combined as proposed in the Office Action, a fuel cell as recited in claim 19 would not be obtained.

Claim 19 is would not have been rendered obvious by Gislason, Ino and Shore. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

D. Ino, Gislason and Shore

The Office Action rejects claims 19 and 31 under 35 U.S.C. §103(a) over Gislason in view of Ino and U.S. Patent No. 6,541,419 to Shore et al. ("Shore"). By this Amendment, claim 31 is cancelled, rendering the rejection moot as to that claim. As to the remaining claim, Applicants respectfully traverse the rejection.

Claim 19 is set forth above. For the reasons discussed above, Ino, Gislason and Shore fail to disclose or suggest each and every feature of claim 19.

Claim 19 would not have been rendered obvious by Ino, Gislason and Shore. Accordingly, reconsideration and withdrawal of the rejection are respectfully requested.

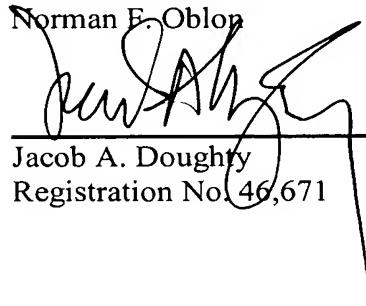
Conclusion

For the foregoing reasons, Applicants submit that claims 13, 14, 16 and 19-29 are in condition for allowance. Prompt reconsideration and allowance are respectfully requested.

Respectfully submitted,

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